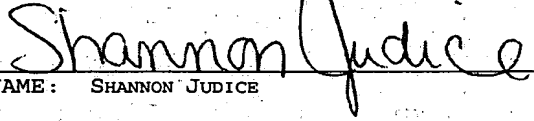


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APPLICATION FOR LETTERS PATENT

FOR

DEVICE FOR FIXING INJECTORS ON A CYLINDER HEAD

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DEVICE FOR FIXING INJECTORS ON A CYLINDER HEAD

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of co-pending International Application No. PCT/DE02/03456 filed September 16, 2002 which designates the United States,  
5 and claims priority to German application number DE10145988.2 filed September 18, 2001.

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a fixing arrangement for mounting an injector on a cylinder head.

10 BACKGROUND OF THE INVENTION

Figure 4 shows a fixing arrangement for mounting an injector on a cylinder head according to the prior art. In this arrangement the injector 1 consists, as is known, of a plurality of injector modules 7, 2, 3 which are  
15 disposed successively in the axial direction M-M of the injector. The main components of the injector here are an injector body 7, a stop disk 2, an injection nozzle 3 and a nozzle tensioning nut 4 which braces the injector modules 7, 2, 3 against one another. In so doing the  
20 nozzle tensioning nut 4 exerts a predefined axial force  $F_v$ . Here, the axial force  $F_v$  is dimensioned such that it provides a sealing function at the interfaces between the individual injector modules and also such that any distortion or stress in the interior of the injector  
25 modules does not exceed a predetermined level in order to prevent damage to the components. The injector 1 pretensioned in this way is sealed via a sealing washer 5 on the cylinder head 6. The force  $F$  necessary to achieve the sealing effect is applied here directly onto the

injector body 1. In order to prevent damage to the components of the injector 1 as a result, this fixing force  $F$  must be limited. However, this also limits the sealing effect between the cylinder head 6 and the injector 1. As a consequence unwanted escapes and leakages can occur between the cylinder head 6 and the injector 1.

#### SUMMARY OF THE INVENTION

The object of the present invention is therefore to provide a fixing arrangement for mounting an injector on a cylinder head which, at the same time as being simple in structure and easy and inexpensive to manufacture, permits improved sealing between the cylinder head and the injector.

This object is achieved by a fixing arrangement with the following features according to one embodiment of the invention: bracing the injector modules of an injector against one another via a pretensioning element, and applying a direct or indirect fixing force to the pretensioning element for mounting the injector to the cylinder head.

The fixing arrangement according to the invention for mounting the injector on the cylinder head is designed in such a way that a fixing force for mounting the injector is applied directly or indirectly to the pretensioning element of the injector. By this means the fixing force can be prevented from acting directly on the injector modules. In this way it is possible to employ a higher fixing force than is used in the prior art, thereby resulting in improved sealing between the

cylinder head and the injector. As the fixing force is no longer applied directly to the injector modules, damage to the injector modules can also be reliably prevented. By introducing the force onto the pretensioning element  
5 of the injector, the fixing force can thus be used fully for the sealing function.

According to a particularly advantageous embodiment of the present invention, the fixing force is preferably applied in the direction in which the force is  
10 introduced, at a position which is located after a first bracing contact between the pretensioning element and the injector modules. In this way it is ensured that the fixing force is directed in its entirety past the injector modules, since the force is applied in the  
15 direction of introduction of the force at the nozzle tensioning nut only after the first bracing contact. Above all this can be used to exploit the fact that the pretensioning element of the injector is not completely rigid, but exhibits a certain flexibility. Thanks to the  
20 advantageously chosen position of the force introduction, this flexibility can be exploited according to the invention to ensure that there are no resulting additional effects on the injector modules braced by the pretensioning element.

25 In order to enable the fixing force to be directed easily past the electric modules, the fixing force is preferably introduced via an additional sleeve-like component. It is particularly preferred in this case if the sleeve-like component acts on a collar embodied on  
30 the pretensioning element. By this means the fixing force is transmitted via the sleeve-like component and the

collar of the pretensioning element directly onto the  
cylinder head. It should be noted that another sealing  
disk can be disposed between the pretensioning element  
and the cylinder head in order to provide a better  
5 sealing function.

In order to ensure that the fixing force has no  
effects on the injector modules, the collar is disposed  
at a lower end area of the pretensioning element. This  
means that the flexibility of the pretensioning element  
10 can be exploited down the entire length of the  
pretensioning element in order to prevent an application  
of force onto the other components of the injector.

According to another preferred embodiment of the  
present invention, a ring-shaped element is disposed  
15 between the pretensioning element and the sleeve-like  
component. In order to keep a radial component of the  
fixing force applied to the pretensioning element as  
small as possible in this case, the ring-shaped element  
preferably has a circular or oval cross-section. The  
20 ring-shaped element can be embodied for example as an  
embossing ring or as a slotted ring.

According to a preferred embodiment of the present  
invention, the ring-shaped element is embodied as a nut  
which is screwed onto an external thread on the  
25 pretensioning element. The fixing force can then be  
applied to the pretensioning element via the nut. When a  
sleeve-like component is used, the use of the nut has the  
advantage compared with the embodiment of a collar on the  
pretensioning element that the sleeve-like component can  
30 also be inserted only once the injector has been  
assembled. When a collar is used, the sleeve-like

component has already to be inserted before the final assembly of the injector, since after the final assembly of the injector it is not possible to insert the sleeve-like component from the side opposite the collar, since  
5 of course there are typically projecting components on the injector for, for example, electrical terminals or fuel supply lines. The use of the nut thus has assembly-related advantages. In this case the external thread for fixing the nut is preferably disposed at a position of  
10 the pretensioning element which is located in the direction of introduction of the force at a position after the first bracing contact of the pretensioning element with the injector modules. It is particularly preferred if the external thread is disposed at the lower  
15 end area of the pretensioning element.

In order to allow a simple design of the injector and the fixing arrangement, the pretensioning element is preferably embodied as a nozzle tensioning nut. In this case a first bracing contact is advantageously provided  
20 via a thread and a second bracing contact by means of a shoulder on the nozzle tensioning nut.

The fixing force is preferably applied to the pretensioning element by means of a claw fixed to the cylinder head. In this case the claw can for example be  
25 screwed onto the cylinder head or calked or fixed in any other way.

By means of the inventive introduction of the fixing force via the pretensioning element of the injector, higher axial forces can therefore be implemented for  
30 providing a seal between the injector and the cylinder head than is possible in the prior art. Particularly

advantageous here is the introduction of the fixing force onto the pretensioning element after a first bracing contact in order to rule out completely any application of force onto components of the injector. A certain  
5 flexibility of the pretensioning element can be exploited here. If the first bracing contact is additionally embodied in the form of a thread, the usable flexibility can be further increased, since the thread further reduces a rigid behavior of the pretensioning element.  
10 This applies in the same way if a nut is provided on the pretensioning element, via which nut the fixing force is introduced.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in the following  
15 with reference to preferred exemplary embodiments in connection with the drawing, in which:

Figure 1 shows a schematic sectional view of a fixing arrangement according to a first exemplary embodiment of the present invention,

20 Figure 2 shows a schematic sectional view of a fixing arrangement according to a second exemplary embodiment of the present invention,

Figure 3 shows a schematic sectional view of a fixing arrangement according to a third exemplary  
25 embodiment of the present invention, and

Figure 4 shows a schematic sectional view of a fixing arrangement according to the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE  
INVENTION

Figure 1 shows a fixing arrangement for mounting an injector 1 onto a cylinder head 6 according to a first  
5 exemplary embodiment.

The injector 1 consists of a plurality of injector modules 7, 2, 3 which are disposed in sequence in the axial direction. More precisely, the injector modules are embodied as injector body 7, stop disk 2 and injection  
10 nozzle 3. The injector modules 7, 2, 3 are braced against one another in the known manner by means of a nozzle tensioning nut 4, whereby a first bracing contact 13 is embodied at the nozzle tensioning nut 4 and a second bracing contact 14 is embodied toward the injector  
15 modules. The first bracing contact 13 is embodied here as a thread and the second bracing contact 14 is embodied as a shoulder in the nozzle tensioning nut 4.

The bracing of the injector modules is now accomplished simply by screwing the nozzle tensioning nut  
20 onto the thread 13. This produces an axial force  $F_v$  for bracing which is dimensioned such that the sealing function is fulfilled between the interfaces of the individual injector modules and also such that no distortion of or excessive stress to the individual  
25 injector modules occurs.

The fixing arrangement for mounting the injector 1 on the cylinder head 6 now consists mainly of a sleeve 8 which is in contact with a collar 9 embodied on the nozzle tensioning nut 4. In this case the collar 9 is  
30 formed at a lower end area 10 on the exterior face of the nozzle tensioning nut 4. According to the invention the



fixing force F is now introduced onto the sleeve 8 so that the force is applied onto the cylinder head 6 via the sleeve 8, the collar 9 and a sealing washer 5 disposed between the nozzle tensioning nut 4 and the  
5 cylinder head 6. As a result the fixing force F is applied in the direction of introduction of the force (as shown in Figure 1, downward in the direction of the arrow F) at a position which is located in the direction of introduction of the force after the first bracing contact  
10 13 (cf. Figure 1).

Since the nozzle tensioning nut 4 is not a completely rigid component but exhibits a certain flexibility, albeit also only to a limited degree, it can be achieved by applying the force after the bracing  
15 contact 13 that the fixing force F has no negative effects on the individual injector modules 7, 2, 3. Accordingly it is possible for a greater fixing force F to be chosen than in the prior art, wherein the fixing force acts via the injector modules (cf. Figure 4). The  
20 use of a higher fixing force F thus enables an improved sealing effect to be achieved at the sealing washer 5 between the injector 1 and the cylinder head 6. At the same time the flexibility is increased even further by the use of the thread as a first bracing contact 13.  
25 According to the invention, the fixing force F is directed past the injector modules in this case.

Figure 2 shows a fixing arrangement according to a second exemplary embodiment of the present invention. In this depiction identical or functionally identical parts  
30 are designated by the same reference characters as in the first exemplary embodiment.

As shown in Figure 2, in contrast to the first exemplary embodiment a slotted embossing ring 11 is disposed between the sleeve 8 and the nozzle nut 4. The fixing force  $F$  is thus transmitted via the sleeve 8 and the embossing ring 11 onto the collar 9 of the nozzle tensioning nut 4 and then onto the sealing areas between the injector 1 and the cylinder head.

The use of the embossing ring 11 produces a resulting introduction of force  $F_G$  onto the nozzle tensioning nut 4, which force is composed of an axial force  $F_A$  and a radial force  $F_R$ . In order to keep the radial force component  $F_R$  to an absolute minimum here, the contact area between the sleeve 8 and the embossing ring 11 is embodied in such a way that, as shown in detail X in Figure 2, the sleeve 8 matches the outer contour of the embossing ring 11. In order to obtain the smallest possible radial force components here, the cross-section of the embossing ring is preferably circular or oval. It should be noted that the connecting area between the sleeve 8 and the embossing ring 11 can also be embodied as a bevel. As in the first exemplary embodiment, a greater fixing force can be utilized by means of the arrangement according to the invention for introducing the fixing force  $F$  at a lower end area 10 of the nozzle tensioning nut 4 and in this way an improved sealing of the injector 1 on the cylinder head 6 can be achieved.

A fixing arrangement according to a third exemplary embodiment of the present invention will be described in the following with reference to Figure 3. In this depiction identical or functionally identical parts are

designated by the same reference characters as in the two preceding exemplary embodiments.

As shown in Figure 3, in the third exemplary embodiment a nut 12 is provided in place of a collar on the exterior face of the nozzle tensioning nut, said nut 12 being screwed onto an external thread 15 at the lower end area 10 of the nozzle tensioning nut 4. In this case the nut 12 assumes the function of the collar 9 in the preceding exemplary embodiments. The fixing force F is thus transmitted via the sleeve 8 and the nut 12 across the lower area of the nozzle tensioning nut 4 onto the sealing surfaces. Compared with the two preceding exemplary embodiments, in the third exemplary embodiment an assembly-related advantage in particular is produced to the extent that the sleeve 8 does not have to be inserted already during the assembly of the injector 1, but can also be inserted after the assembly of the injector. Following this, the nut 12 is then screwed onto the external thread 15 on the nozzle tensioning nut 4.

It should be noted that in all the above described exemplary embodiments the fixing force F is generated for example by means of a claw which is fixed to the cylinder head 6.

The nut 12 can be embodied for example as a grooved nut which has cutouts on its supporting surfaces so that it can be screwed on by means of a special tool. In this way it is possible to prevent the introduction of too great radial forces that might take place if a normal nut were to be used.

The present invention therefore relates to a fixing arrangement for mounting an injector 1 on a cylinder head

6. The injector 1 has a plurality of injector modules 7,  
2, 3 disposed in sequence in the axial direction which  
are braced against one another by means of a  
pretensioning element 4. A fixing force F for mounting  
5 the injector 1 acts on the pretensioning element 4 in  
order to prevent disadvantageous force effects on the  
injector modules.

The present invention is not limited to the  
exemplary embodiments described. Different variations and  
10 modifications can be executed without leaving the scope  
of the invention.